REMARKS

Applicants amend claims 1, 33, 50, 52, 53 and 54, as noted above, and cancel claims 21 and 31 without prejudice. Support for the amendments can be found, e.g., on pages 4, 8 and 12, in the original claims and throughout the remainder of the specification. Reconsideration and allowance of the application are respectfully requested.

Claims Objections

The Office Action objects to claims 21 and 31 for allegedly broadening the scope of independent claim 1, on which they depend. Without acquiescing to the objections, these claims are canceled, as noted above, in order to expedite the prosecution of the application.

In response to the objection to claim 52, that claim is amended to replace "solution of a bioactive material" with "solution of the bioactive material" in order to clarify that the bioactive material refers to the one recited in independent claim 50 on which claim 52 depends.

Rejections Pursuant to 35 U.S.C. §102

Claims 1, 4, 8, 10, 16-17, 19, 21-22, 24-25, 27-28, 31, 33, 36 and 49-52 are rejected as being anticipated by U.S. Patent No. 6,136,389 of Conover.

Claim 1, as amended, recites a method of treating an inner surface of a tubular article having a lumen, where the method comprises the steps of: generating a gaseous plasma within a spatially-localized region of space by electron cyclotron resonance, exposing at least a portion of an inner surface of the lumen of the tubular article to said plasma for a selected time period to treat the surface and cause at least one surface modification selected from the group consisting of increased surface energy, crosslinking and chemical bond scission, and subsequently, coating said treated surface with a selected bioactive material *by contacting a solution of the bioactive material with the lumen*. The bioactive material can be any of an anti-thrombogenic, an anti-coagulant, an anti-biotic or an anti-microbial material.

Conover is directed to preparing thin films of noble *metals* upon porous substrates. More specifically, it employs a plasma to cause the release of a noble metal from a precursor to be

deposited on the substrate. Conover further indicates that articles can be sequentially coated via the metallization process followed by a plasma polymerized coating of monomers such as propylene or siloxane. In some cases, after the deposition of the metal film, the film can be used to form metal complexes, e.g., by electrodeposition.

Conover, however, does not teach a two step process for coating an inner surface of a tubular lumen in which in an initial step, the surface is exposed to an ECR plasma, and subsequently the treated surface is coated with a bioactive material by contacting a solution of that material with the lumen. Even if one considers the metallization step in those embodiments of Conover directed to sequential coating or formation of metal complexes as corresponding to the surface treatment step in claim 1 – as the Examiner does – that step is not followed by coating that metallic layer with a bioactive material by contacting a solution of the material with the metallic layer. Rather, a subsequent coating of the metallic layer or formation of metallic complexes thereon are achieved via techniques such as plasma deposition or electroplating.

Moreover, there is no indication in Conover that the metallic layer is coated with a bioactive material selected from the group consisting of an anti-thrombogenic, an anti-coagulant, an anti-biotic or an anti-microbial material. The statement in Conover, to which the Examiner refers, that platinum and platinum-group metal complexes are of increasing importance in bio-affinity applications (such as genosensors, DNA probes, biopurification and separation) provides no indication that those complexes have any of an anti-thrombogenic, an anti-coagulant, an anti-biotic or an anti-microbial property.

Hence, independent claim 1, and claims 4, 8, 10, 16, 17, 19, 22, 24, 25, 27, 28, and 31 that depend either directly or indirectly on claim 1, are patentable over the cited art.

The reasoning provided above in connection with claim 1 applies equally to establish that independent amended claims 33 and 50 are also patentable. In particular, Conover fails to teach the two step process of surface treatment and coating the treated surface with a bioactive material that is recited in amended claims 33 and 50.

Accordingly, independent claim 33, and claims 36 that depends on 33, as well as independent claim 50, and claim 52 that depends on 50, are patenable over the cited art.

Rejections Pursuant to 35 U.S.C. §103(a)

Claims 1, 4-8, 10-19, 21-28, 31, 33-39 and 49-52 are rejected as being obvious over U.S. Patent No. 5,914,115 of Subramanian in view of U.S. Patent No. 4,927,676 of Williams, further considering U.S. Patent No. 6,136,389 of Conover or U.S. Patent No. 5,601,883 of Yamazaki and/or U.S. Patent No. 5,053,244 of Kieser and/or U.S. Patent No. 4,897,285 of Wilhelm.

Subramanian is directed to providing covalently attached therapeutic coatings for surfaces of medical devices. To functionalize a surface of a medical device, Subramanian oxidizes that surface by utilizing a plasma created via radiofrequency ("RF") glow discharge.

Subramanian, however, fails to teach or suggest utilizing an ECR plasma for treating the inner surface of a tubular article to facilitate subsequent coating of that surface with a bioactive material. In fact, Subramanian is not concerned with treating *inner* surfaces of the lumens of tubular articles. Rather, its teachings are primarily directed to coating vascular stents that have relatively open structures – a vascular stent is formed as an expandable wire mesh. Even when Subramanian refers to catheters, there is no indication that it is concerned with their inner lumens. For example, in one specific embodiment, it cites "an intracardial catheter probe for introduction into a chamber of the heart" that comprises a flexible elongate tubular member having a distal extremity to which expandable means are secured. The expandable means include a plurality of plastic elements having surfaces that are *exposed* to blood when in an expanded position. Such surface are not, however, the inner surfaces of the catheter's lumen.

Notwithstanding this lack of disclosure regarding coating the interior surfaces of tubular articles, the Examiner relies on the statement in Subramanian that "the invention also provides generally methods for treating a surface of a medical device to inhibit thrombosis which involves causing a bioactive agent to become covalently bound to a medical device surface exposed to blood flow" to assert that it suggests coating interior of tubes. This general statement – even if construed to suggest coating interior of tubes – does not provide any motivation to look for

alternative plasma techniques for doing so. In fact, Subramanian does not indicate any shortcomings with regard to glow discharge plasmas.

Further, Williams, which is generally directed to forming a confluent layer of endothelial cells over a polymeric substrate functionalized by exposure to a nitrogen-containing plasma, does not teach utilizing an ECR plasma for functionalizing the substrate. It recites that a conventional plasma generator may be used, such as thermal, radio frequency, direct current, audio frequency and microwave plasmas ..." The Examiner appears to rely on this statement to conclude that Williams shows "the equivalent usefulness of RF glow discharge & microwave plasmas for like plasma pretreatment of tubular substrates." Applicants respectfully disagree. The fact that various techniques can be employed does not necessarily mean that all of those techniques are equally useful. Further, the mere mention of microwave plasmas does not necessarily relate to the use of ECR in which a magnetic field is utilized to ensure *localized* treatment of a surface. In particular, Applicants teach the use of ECR provides distinct advantages over other types of plasmas. For example, an ECR plasma can be controlled via the application of the magnetic field to allow targeting a particular surface area for treatment. In contrast, conventional discharges do not typically permit treating a selected portion of a surface without affecting the remainder of that surface.

Further, Yamazaki, which is directed to a microwave enhanced chemical vapor deposition method of coating plastic articles, does not teach or suggest coating the *internal* surfaces of those articles. Rather, Yamazaki's methods relate to coating external surfaces of the articles via exposure to a plasma generated in a gas by microwave energy and a magnetic field.

Moreover, Conover fails to teach or suggest the salient features of the claimed subject matter, as discussed in detail above.

Further, both Kieser and Wilhelm describe methods for *direct* deposition of a coating material from a plasma onto a surface, and not the two-step process of claim 1 that includes initially treating an inner surface of a lumen with an ECR plasma and *subsequently* coating the treated surface.

Hence, independent claim 1, and claims 4-8, 10-19, 21-28, and 31, which depend directly or indirectly on claim 1, are believed to be patentable over the cited art.

Similar reasoning applies to establish that amended independent claims 33 and 50, as well as claims 34-39, which depend directly or indirectly on 39, and claim 52, which depends on 50, are patentable over the cited art.

In Paragraph 8 of the Office Action, claims 5-7, 11-15, 22, 25-26, 34-35 and 37 are rejected as being obvious over Conover.

Claims 5-7, 11-15, 22, 25-26 depend directly or indirectly on independent claim 1, and claims 34-35 and 37 depend directly or indirectly on independent claim 33. As discussed above, Conover fails to teach or suggest the salient features of claim 1 or 33, and consequently those of the claims that depend on them.

In Paragraph 9 of the Office Action, independent claims 53 and 54 are rejected as being obvious over Conover in view of Wilhelm and U.S. Patent No. 5,976,257 of Kanai & optionally Kieser.

Independent claim 53 recites a method of selectively treating an internal surface of a tubular article having a lumen, comprising: placing at least a portion of the tubular article in a treatment zone to which a magnetic field having a selected strength is applied, introducing a gas into the article's lumen so as to generate an internal pressure that is different from an external pressure to which an outer surface of said portion is exposed, irradiating *at least an interior portion and an exterior portion of the tubular article* with electromagnetic radiation having a frequency selected to be substantially equal to electron cyclotron frequency at said magnetic field strength so as to generate a plasma within said lumen portion for treating a surface thereof, wherein said external pressure inhibits formation of a plasma in proximity of the outer surface, and subsequently, coating said treated lumen surface with a selected material.

Independent claim 54 recites a method of selectively treating an outer surface of a tubular article having a lumen, which includes: placing at least a portion of the tubular article in a treatment zone containing a gas at a selected pressure such that an outer surface of at least a portion of said article is exposed to the gas, causing an internal pressure within a lumen of the tubular portion to be different than said treatment zone pressure *by flowing a gas through said lumen*, generating an ECR plasma within said treatment zone so as to treat said outer surface by exposure to said plasma while said internal pressure inhibits formation of a plasma within said lumen portion, and subsequently, coating said treated outer surface with a selected material.

The Examiner asserts that the reference in Conover to 'single side' and 'counter flow' for controlling the platinization layer suggests that flow and hence pressure is involved. The Examiner agrees that Conover does not specifically disclose the use of a pressure differential to selectively subject an interior surface of a tubular article to a plasma while inhibiting the plasma formation in vicinity of its exterior surface. Further, in Wilhelm, only the interior portion of the pipe is subjected to microwave irradiation – the pipe functions as a waveguide for the microwave radiation. In contrast, claim 53 recites that a portion of the exterior of the tubular article, in addition to a portion of its interior, is subjected to irradiation, and the plasma formation is inhibited in proximity of the outer surface via a pressure differential.

Further, Kanai and Kieser fail to cure the shortcomings of Conover and Wilhelm. In particular, Kanai simply describes utilizing a mesh member to prohibit microwave leakage through an exhaust port of a CVD apparatus while permitting gas exhaust through the port. Further, Kieser is not concerned with selectively exposing an interior of an article to a plasma while inhibiting plasma formation in the vicinity of an outer surface thereof.

Hence, claim 53 is believed to be patentable over the cited art.

With regard to claim 54, none of the references teaches or suggests flowing a gas through an interior of a tubular article so as to inhibit plasma formation therein while exposing a portion of the article's outer surface to the plasma. For example, Wilhelm does not inhibit formation of a plasma within the waveguide. On the contrary, it employs a plasma to coat the *interior* surface

of the waveguide. Nor does any of the other references teach the method of selectively coating an outer surface of a tubular article while flowing a gas through a lumen of that article to inhibit the formation of a plasma therein, which is recited in claim 54.

Hence, claim 54, and claims 55-58, which depend directly or indirectly on 54, are patentable over the cited art.

In Paragraph 10, claims 53-58 are rejected as being obvious over Subramanian in view of Williams, further considering Conover, and further in view of Wilhelm & Kanai & optionally Kieser.

The arguments presented above apply with equal force to establish that claims 53-58 are patentable over the combined teachings of the cited references.

CONCLUSION

In view of the above amendments and remarks, Applicants respectfully request reconsideration and allowance of the application. The Examiner is invited to call the undersigned if there are any questions.

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Respectfully submitted,

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